

Marsupial Mole Monitoring Survey

April 2014



Lake Disappointment Potash Project Reward Minerals Ltd

MAY 2015
VERSION 1

On behalf of:

Reward Minerals Limited
PO Box 1104
NEDLANDS WA 6909
T: (08) 9386 4699
E: admin@rewardminerals.com

Prepared by:

Greg Harewood
Zoologist
PO Box 755
BUNBURY WA 6231
M: 0402 141 197
T/F: (08) 9725 0982
E: gharewood@iinet.net.au



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SUMMARY

The monitoring survey reported on here was carried out in compliance with an approved Conservation Management Plan (Botanica 2013) and aims to provide a baseline dataset on marsupial mole activity for areas within and/or near Reward Minerals Limited Lake Disappointment Potash Project area.

The survey was completed over a period of three days (7, 8 and 9) in April 2014 and employed methods generally following, in part, those used by Benshemesh and Mann (2009) during their survey within the Great Sandy, Gibson and Little Sandy Deserts and as also detailed in Benshemesh (2005). These methods include searching for subsurface signs of marsupial moles by digging small trenches and examining the soil profile for “moleholes” (the backfilled tunnels made by marsupial moles while tunnelling underground).

During the monitoring survey 20 trenches were examined in which 76 backfilled tunnels larger than 20 mm were recorded. Only one trench site contained no apparent evidence of mole activity. The moleholes observed generally had characteristics similar to those previously recorded by Benshemesh and Mann (2009) in their survey across north-central WA.

The moleholes observed averaged 39.9 mm in diameter and occurred most commonly in the 21-40 cm depth range (50 % of all observations). Fresh moleholes were found in two of the 76 trenches. Moleholes classified as recent were found in three trenches.

The current study has confirmed that marsupial moles are active in Reward’s Lake Disappointment Potash Project area and the data collected supports Benshemesh and Mann’s (2009) conclusion that the marsupial moles are widespread and probably far more common than previous records suggest. It is not however possible to estimate the population size as the rates of decay and creation of moleholes is still uncertain. Studies are underway to estimate these quantities (Benshemesh and Mann 2009).

1. INTRODUCTION

This report details the results of a marsupial mole monitoring survey carried out within sections of Reward Minerals Limited (Reward) Lake Disappointment Potash (LDP) Project area situated within the Little Sandy Desert, approximately 180km south of Telfer and 285km east of Newman, Western Australia.

The survey was carried out in compliance with an approved Conservation Management Plan (CMP) (Botanica 2013) monitoring program and aims to provide a baseline dataset for areas within and/or near potential mine and associated infrastructure areas. It is anticipated that ultimately the survey results may be taken into consideration by State and Federal environmental regulatory authorities when future applications to carry out exploration, testing and mining are submitted for approval.

2. METHODS

Direct examination of marsupial mole ecology is virtually impossible with current techniques primarily due to their cryptic subterranean habits and conventional trapping methods such as the use of Elliot traps or pitfall traps are ineffective in detecting the presence of the species.

Previously, studies have however shown that indirect methods provide a means for examining the distribution and abundance of marsupial moles (Benshemesh 2005, Benshemesh and Mann 2009). These methods include searching for subsurface signs of marsupial moles by digging small trenches and examining the soil profile for “moleholes” (the backfilled tunnels made by marsupial moles while tunnelling underground), a method which can provide information on distribution and an index of abundance.

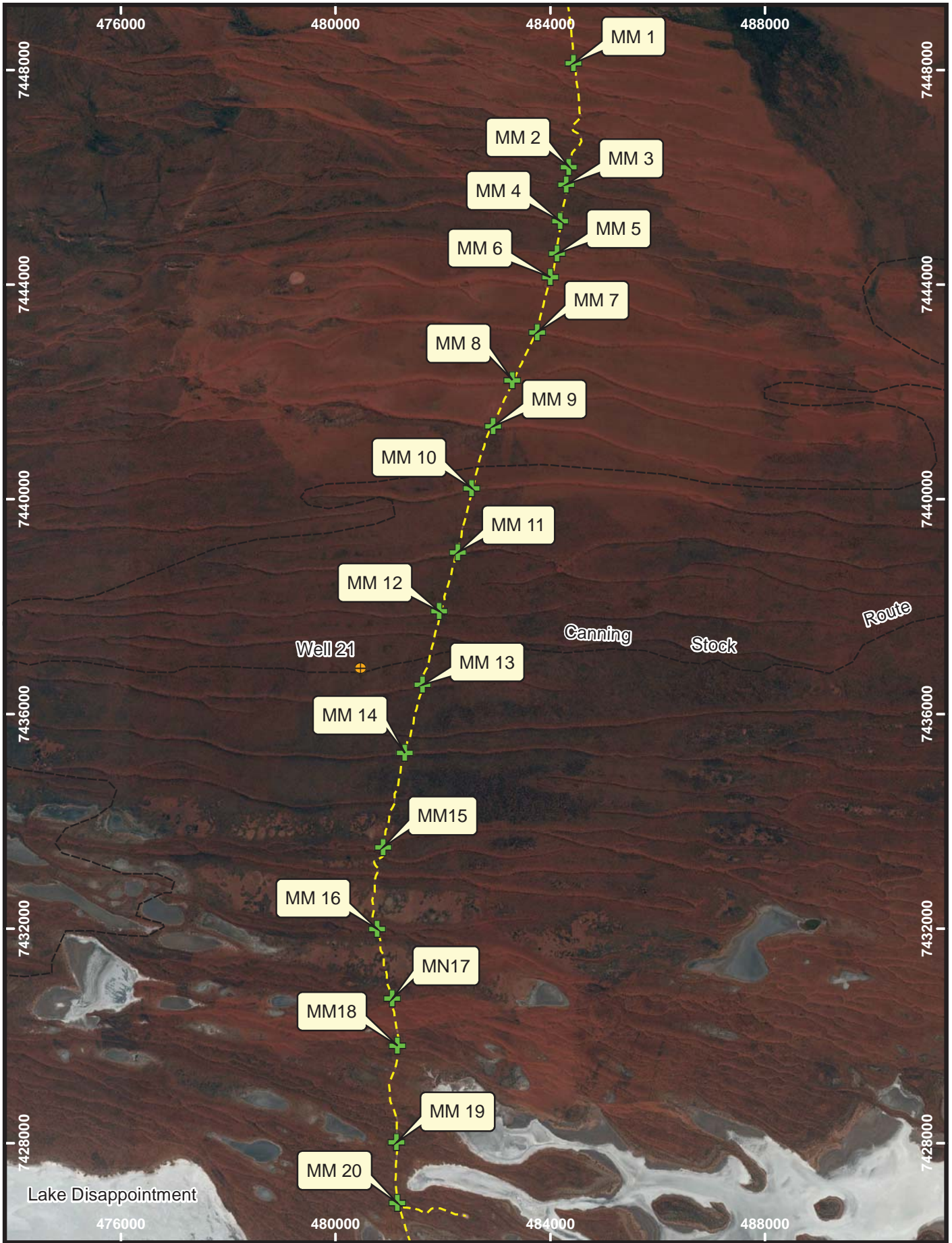
The monitoring survey reported on here has employed this technique using methods generally following, in part, those used by Benshemesh and Mann (2009) during their survey within the Great Sandy, Gibson and Little Sandy Deserts and as also detailed in Benshemesh (2005).

2.1 SURVEY TEAM AND TIMING


The monitoring survey team comprised Samantha Stapleton, Jim Williams and Greg Harewood. The survey was completed over a period of three days (7, 8 and 9) in April 2014.

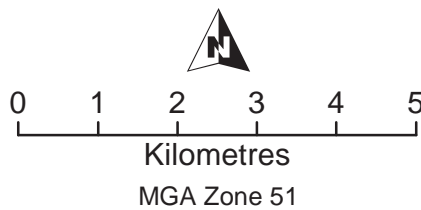
2.2 TRENCHES

Monitoring was carried out on 20 pre-selected dunes along a ~22 km section of the Willjabu Track from near Lake Disappointment northwards (Figure 1). As can be seen in Figure 1, most dunes along the track are aligned in an east west direction.



Legend

-  Marsupial Mole Monitoring Trench Site



DRAWN: G Harewood
 DATE : April 2014
 SCALE: 1:95,000

Reward Minerals Ltd
Lake Disappointment
Potash Project
Marsupial Mole
Monitoring Trench
Sites

Figure: 1

A single trench was dug at each site near the mid-section of the dune's north facing slope. The precise location of each trench was influenced by existing vegetation and where possible they were positioned away from trees and large shrubs to minimise damage to vegetation while facilitating easy digging. Only one trench was dug at each dune, the objective being to maximise the coverage of the survey rather than to provide detailed information on marsupial mole abundance at each site.

Trenches were dug to a standard size of about 120cm long by 80cm deep and 40cm wide. Trenches were orientated with their long axis in an east west direction so as to provide maximum exposure of the north facing wall of each trench to the sun. The top of the opposite wall was also dug out to reduce shading towards the base of the trench.

Trenches were backfilled once data had been collected.

2.3 MOLEHOLE TRENCH DATA

The north facing trench wall was the only trench face that was inspected for marsupial mole signs. Prior to data being recorded this face was gently rubbed to present a flat and smooth surface. Sand was also thrown onto this face so as to gently erode the surface, making the edges of any moleholes present more apparent, as typically the backfilled passage erodes more than the surrounding sand.

All oval and symmetrical sand filled structures with a minimum dimension greater than about 20 mm were measured in regard to their depth from surface, minimum and maximum dimensions, and the angle of their long axis from vertical (measured with a plumb). In addition, each structure was scored from 1 (low) to 3 (high) in regard to its clarity, and how confident the observer was that the structure was from a marsupial mole. Structures were also rated for how fresh they appeared with scores ranging from very old to fresh.

A summary of all the data recorded is provided below.

General Information

Date, Observers, Trench Name and GPS Coordinates.

Trench Length and Depth (cm).

Molehole Data

Molehole #: Number for that site.

Depth: Distance from surface to centre of molehole (cm).

X: Distance to centre of molehole from the right side wall of the trench.

D¹: Minimum diameter (mm) of molehole.

D²: Maximum diameter (mm) of molehole.

Clarity: 1 (very unclear), 2 (clear) or 3 (very clear).

Angle: The angle of the long axis of the molehole. 0-90° (only measured where D² is clearly greater than D¹. A symmetrical hole has an angle of 90°.

Confidence: 1(not confident object is made by marsupial mole), 2 (confident) or 3 (very confident).

Age: very old, old, oldish, recent, fresh.

Additional explanations on these criteria can be found within Benshemesh and Mann (2009) and Benshemesh (2005).

3. RESULTS

3.1 MOLEHOLE TRENCH DATA

A total of 76 structures over 20mm in size, attributed to marsupial moles tunnelling underground were recorded within the 20 trenches dug during the monitoring survey. Only one trench (MM5) appeared not to contain any evidence of marsupial mole activity.

The molehole monitoring records sheets are held in Appendix A. A summary of this data including statistical tables on the various attributes discussed below are held in Appendix B.

3.2 CHARACTERISTIC ATTRIBUTES OF BACKFILLED TUNNELS

3.2.1 Size and shape of backfilled tunnels

Dmin (D¹) is an important diagnostic feature of moleholes and as it is expected to be relatively constant regardless of the structure's age, condition and the angle at which they are intercepted (Benshemesh in prep.).

The moleholes detected at Lake Disappointment (LD) had an average minimum diameter (D¹) of 39.9 mm with 63% being recorded as 40mm and 17% as 35mm (i.e. 80% between 35 and 40mm). This result appears to be slightly higher than obtained by Benshemesh and Mann (2009) in their study across north-central WA (NCWA) where an average of 36 mm was obtained though it should be noted that in their study measurements were taken to the nearest millimetre whereas during the LD survey measurements were only taken to the nearest 5mm, making precise comparisons difficult.

While the D_{min} (D^1) measure is expected to be relatively insensitive to how tunnels are intercepted, the D_{max} (D^2) measure is determined by both the original size of the tunnel, and the angle at which it is intercepted (Benshemesh and Mann 2009).

D_{max} (D^2) frequency distributions for LD peaked at 40mm which is again similar to Benshemesh and Mann's (2009) NCWA study where figures peaked in the 36-40mm size class, though as mentioned because LD measurements were only taken to the nearest 5mm, more precise comparisons are difficult.

3.2.2 Depth from surface of backfilled tunnels

The depth at which moleholes and other structures occur from the surface reflects the ecological preferences of the animals and also provides a means of comparing backfilled tunnels measured at LD with those previously measured in Benshemesh and Mann's (2009) NCWA study.

Moleholes at LD occurred most commonly in the 21-40 cm depth range (50 % of all observations), and were progressively less common away from this band. This observation is consistent with Benshemesh and Mann's (2009) NCWA study where a similar trend (~49%) was observed though a slightly higher number of shallower tunnels were recorded in their study (~33% compared to 25%) while a higher percentage of deeper tunnels were recorded at LD (25% compared to ~20%).

3.2.3 Age of backfilled tunnels

Two indices are likely to reflect the age of moleholes: the subjective score for age, and the relative hardness of sand within each backfilled tunnel compared to the surrounding matrix. The relative hardness of the sand was not measured during the LD survey.

Age classes recorded at LD showed a broadly similar frequency distribution to that recorded in the NCWA, although differences were evident. This difference may reflect difficulty in consistently discriminating between some adjacent categories (e.g. old and oldish) rather than actual differences in moleholes given it is a subjective assessment.

The most important and clearly defined age category is Fresh which is characterised by sand flowing freely from moleholes without inducement (Benshemesh and Mann 2009). At LD fresh moleholes were found in two of the 76 trenches. Moleholes classified as recent were found in three trenches. The frequency of Fresh moleholes at LD and NCWA was similar (3% and 4% respectively).

4. CONCLUSION

The monitoring survey reported on here provides some baseline data on marsupial mole activity in Reward's LDP Project area which can be used for comparison with any additional data collected in this area in the future.

During the monitoring survey 20 trenches were examined in which 76 backfilled tunnels larger than 20 mm were recorded. Only one trench site contained no apparent evidence of mole activity. The moleholes observed generally had characteristics similar to those previously recorded by Benshemesh and Mann (2009) in their survey across north-central WA.

The current study has confirmed that marsupial moles are active in Reward's Lake Disappointment Potash (LDP) Project area and the data collected supports Benshemesh and Mann's (2009) conclusion that the marsupial moles are widespread and probably far more common than previous records suggest. It is not however possible to estimate the population size as the rates of decay and creation of moleholes is still uncertain. Studies are underway to estimate these quantities (Benshemesh and Mann 2009).

5. REFERENCES

Benshemesh, J. (2005). Manual for Marsupial Mole survey and monitoring by trenches, Version 1.0. Anangu-Pitjantjatjara Land Management and the Department of Environment and Heritage SA.

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Botanica Consulting (2013). Lake Disappointment Potash Project Conservation Management Plan. Unpublished report for Reward Minerals Ltd.

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APPENDIX A

Marsupial Mole Monitoring Record Sheets

Date:	10/04/2014	Observers:	JW, GH, SS
Trench Name:	MM1	GPS Coordinates:	51 K 484434 7448132
Trench LENGTH:	130cm	Trench DEPTH:	80cm
Comments:			

MOLEHOLES

Molehole #:	1		
Depth:	20	X:	30
D¹, D²:	4, 4	Clarity:	3
Angle:	90	Confidence:	3
Pin, Pout:		Age:	oldish
Comments:			

Molehole #:	2		
Depth:	43	X:	44
D¹, D²:	3.5, 3.5	Clarity:	2
Angle:	90	Confidence:	3
Pin, Pout:		Age:	old
Comments:			

Molehole #:	3		
Depth:	48	X:	47
D¹, D²:	3.5, 3.5	Clarity:	2
Angle:	90	Confidence:	3
Pin, Pout:		Age:	old
Comments:			

Date:	10/04/2014	Observers:	JW, GH, SS
Trench Name:	MM2	GPS Coordinates:	51 K 484350 7446194
Trench LENGTH:	130	Trench DEPTH:	82
Comments:			

MOLEHOLES

Molehole #:	1		
Depth:	32	X:	6
D ¹ , D ² :	4, 4	Clarity:	3
Angle:	90	Confidence:	3
Pin, Pout:		Age:	oldish
Comments:			

Molehole #:	2		
Depth:	8	X:	69
D ¹ , D ² :	4, 4.5	Clarity:	3
Angle:	90	Confidence:	3
Pin, Pout:		Age:	Fresh
Comments:			

Molehole #:	3		
Depth:	43	X:	60
D ¹ , D ² :	4, 4	Clarity:	3
Angle:	90	Confidence:	3
Pin, Pout:		Age:	oldish
Comments:			

Molehole #:	4		
Depth:	34	X:	90
D ¹ , D ² :	3, 3	Clarity:	2
Angle:	90	Confidence:	3
Pin, Pout:		Age:	oldish
Comments:			

Molehole #:	5		
Depth:	53	X:	97
D ¹ , D ² :	4, 4	Clarity:	2
Angle:	90	Confidence:	3
Pin, Pout:		Age:	old
Comments:			

Date:	10/04/2014	Observers:	JW, GH, SS
Trench Name:	MM3	GPS Coordinates:	51 K 484299 7445866
Trench LENGTH:	120	Trench DEPTH:	86
Comments:			

MOLEHOLES

Molehole #:	1		
Depth:	8	X:	78
D¹, D²:	4, 7	Clarity:	3
Angle:	10	Confidence:	3
Pin, Pout:		Age:	Recent
Comments:			

Molehole #:	2		
Depth:	29	X:	14
D¹, D²:	4, 8	Clarity:	2
Angle:	75	Confidence:	2
Pin, Pout:		Age:	oldish
Comments:			

Molehole #:	3		
Depth:	36	X:	10
D¹, D²:	4, 7	Clarity:	2
Angle:	75	Confidence:	2
Pin, Pout:		Age:	oldish
Comments:			

Molehole #:	4		
Depth:	58	X:	47
D¹, D²:	4, 4	Clarity:	2
Angle:	90	Confidence:	3
Pin, Pout:		Age:	old
Comments:			

Date:	10/04/2014	Observers:	JW, GH, SS
Trench Name:	MM4	GPS Coordinates:	51 K 484187 7445187
Trench LENGTH:	120	Trench DEPTH:	77
Comments:			

MOLEHOLES

Molehole #:	1		
Depth:	28	X:	50
D ¹ , D ² :	4, 4	Clarity:	2
Angle:	90	Confidence:	3
Pin, Pout:		Age:	old
Comments:			

Molehole #:	2		
Depth:	13	X:	14
D ¹ , D ² :	3.5, 3.5	Clarity:	2
Angle:	90	Confidence:	3
Pin, Pout:		Age:	oldish
Comments:			

Molehole #:	3		
Depth:	25	X:	72
D ¹ , D ² :	4, 4	Clarity:	3
Angle:	90	Confidence:	3
Pin, Pout:		Age:	oldish
Comments:			

Molehole #:	4		
Depth:	20	X:	48
D ¹ , D ² :	4, 4	Clarity:	2
Angle:	90	Confidence:	2
Pin, Pout:		Age:	old
Comments:			

Molehole #:	5		
Depth:	12	X:	106
D ¹ , D ² :	4, 4	Clarity:	2
Angle:	90	Confidence:	2
Pin, Pout:		Age:	old
Comments:			

Date:	10/04/2014	Observers:	JW, GH, SS
Trench Name:	MM5	GPS Coordinates:	51 K 484130 7444577
Trench LENGTH:	130	Trench DEPTH:	80
Comments:			

MOLEHOLES

0

Date:	10/04/2014	Observers:	JW, GH, SS
Trench Name:	MM6	GPS Coordinates:	51 K 484005 7444138
Trench LENGTH:	135	Trench DEPTH:	83
Comments: Dunes appear to be partly mobile i.e. shifting sand			

MOLEHOLES

Molehole #:	1		
Depth:	17	X:	126
D¹, D²:	4, 6	Clarity:	2
Angle:	90	Confidence:	3
Pin, Pout:		Age:	oldish
Comments:			

Molehole #:	2		
Depth:	5	X:	31
D¹, D²:	4, 4	Clarity:	2
Angle:	90	Confidence:	2
Pin, Pout:		Age:	old
Comments:			

Date:	10/04/2014	Observers:	JW, GH, SS
Trench Name:	MM7	GPS Coordinates:	51 K 483763 7443119
Trench LENGTH:	130	Trench DEPTH:	80
Comments:			

MOLEHOLES

Molehole #:	1		
Depth:	26	X:	58
D¹, D²:	4.5, 7	Clarity:	3
Angle:	78	Confidence:	3
Pin, Pout:		Age:	oldish
Comments:			

Molehole #:	2		
Depth:	47	X:	44
D¹, D²:	4, 4	Clarity:	2
Angle:	90	Confidence:	3
Pin, Pout:		Age:	oldish
Comments:			

Molehole #:	3		
Depth:	12	X:	60
D¹, D²:	4, 12	Clarity:	2
Angle:	75	Confidence:	3
Pin, Pout:		Age:	oldish
Comments:			

Date:	10/04/2014	Observers:	JW, GH, SS
Trench Name:	MM8	GPS Coordinates:	51 K 483298 7442219
Trench LENGTH:	120	Trench DEPTH:	77
Comments:			

MOLEHOLES

Molehole #:	1		
Depth:	25	X:	80
D¹, D²:	4.5, 5	Clarity:	3
Angle:	90	Confidence:	3
Pin, Pout:		Age:	Fresh
Comments:			

Molehole #:	2		
Depth:	62	X:	38
D¹, D²:	4.5, 4.5	Clarity:	2
Angle:	90	Confidence:	3
Pin, Pout:		Age:	oldish
Comments:			

Molehole #:	3		
Depth:	14	X:	119
D¹, D²:	3.5, 4	Clarity:	2
Angle:	90	Confidence:	2
Pin, Pout:		Age:	oldish
Comments:			

Molehole #:	4		
Depth:	7	X:	32
D¹, D²:	3.5, 4.5	Clarity:	2
Angle:	90	Confidence:	3
Pin, Pout:		Age:	oldish
Comments:			

Date:	10/04/2014	Observers:	JW, GH, SS
Trench Name:	MM9	GPS Coordinates:	51 K 482942 7441364
Trench LENGTH:	110	Trench DEPTH:	70
Comments:			

MOLEHOLES

Molehole #:	1		
Depth:	40	X:	22
D¹, D²:	3.5, 3.5	Clarity:	2
Angle:	90	Confidence:	3
Pin, Pout:		Age:	oldish
Comments:			

Molehole #:	2		
Depth:	10	X:	31
D¹, D²:	3.5, 3.5	Clarity:	3
Angle:	90	Confidence:	3
Pin, Pout:		Age:	oldish
Comments:			

Molehole #:	3		
Depth:	16	X:	23
D¹, D²:	4, 4	Clarity:	2
Angle:	90	Confidence:	3
Pin, Pout:		Age:	oldish
Comments:			

Date:	10/04/2014	Observers:	JW, GH, SS
Trench Name:	MM10	GPS Coordinates:	51 K 482538 7440205
Trench LENGTH:	135	Trench DEPTH:	84
Comments:			

MOLEHOLES

Molehole #:	1		
Depth:	26	X:	57
D¹, D²:	3.5, 5	Clarity:	2
Angle:	64	Confidence:	3
Pin, Pout:		Age:	oldish
Comments:			

Molehole #:	2		
Depth:	30	X:	34
D¹, D²:	4, 5	Clarity:	2
Angle:	55	Confidence:	2
Pin, Pout:		Age:	old
Comments:			

Molehole #:	3		
Depth:	27	X:	106
D¹, D²:	4, 15.5	Clarity:	3
Angle:	75	Confidence:	3
Pin, Pout:		Age:	oldish
Comments:			

Molehole #:	4		
Depth:	35	X:	112
D¹, D²:	3.5, 3.5	Clarity:	2
Angle:	90	Confidence:	3
Pin, Pout:		Age:	old
Comments:			

Date:	10/04/2014	Observers:	JW, GH, SS
Trench Name:	MM11	GPS Coordinates:	51 K 482277 7439012
Trench LENGTH:	125	Trench DEPTH:	74
Comments:			

MOLEHOLES

Molehole #:	1		
Depth:	47	X:	33
D¹, D²:	3, 3	Clarity:	2
Angle:	90	Confidence:	2
Pin, Pout:		Age:	old
Comments:			

Molehole #:	2		
Depth:	53	X:	115
D¹, D²:	4.5, 5	Clarity:	2
Angle:	90	Confidence:	3
Pin, Pout:		Age:	old
Comments:			

Molehole #:	3		
Depth:	2.3	X:	115
D¹, D²:	4.5, 6	Clarity:	2
Angle:	90	Confidence:	3
Pin, Pout:		Age:	oldish
Comments:			

Date:	10/04/2014	Observers:	JW, GH, SS
Trench Name:	MM12	GPS Coordinates:	51 K 481936 7437913
Trench LENGTH:	145	Trench DEPTH:	79
Comments:			

MOLEHOLES

Molehole #:	1		
Depth:	26	X:	66
D ¹ , D ² :	4, 4	Clarity:	2
Angle:	90	Confidence:	2
Pin, Pout:		Age:	old
Comments:			

Molehole #:	2		
Depth:	24	X:	47
D ¹ , D ² :	4, 4	Clarity:	2
Angle:	90	Confidence:	2
Pin, Pout:		Age:	old
Comments:			

Molehole #:	3		
Depth:	48	X:	51
D ¹ , D ² :	4.5, 4.5	Clarity:	2
Angle:	90	Confidence:	2
Pin, Pout:		Age:	old
Comments:			

Molehole #:	4		
Depth:	50	X:	15
D ¹ , D ² :	4, 4.5	Clarity:	2
Angle:	90	Confidence:	3
Pin, Pout:		Age:	old
Comments:			

Molehole #:	5		
Depth:	50	X:	25
D ¹ , D ² :	4, 5	Clarity:	2
Angle:	90	Confidence:	3
Pin, Pout:		Age:	old
Comments:			

Date:	10/04/2014	Observers:	JW, GH, SS
Trench Name:	MM13	GPS Coordinates:	51 K 481620 7436543
Trench LENGTH:	150	Trench DEPTH:	72
Comments:			

MOLEHOLES

Molehole #:	1		
Depth:	22	X:	32
D ¹ , D ² :	4, 4	Clarity:	3
Angle:	90	Confidence:	3
Pin, Pout:		Age:	oldish
Comments:			

Molehole #:	2		
Depth:	34	X:	40
D ¹ , D ² :	4, 4	Clarity:	3
Angle:	90	Confidence:	3
Pin, Pout:		Age:	oldish
Comments:			

Molehole #:	3		
Depth:	21	X:	70
D ¹ , D ² :	5, 8	Clarity:	2
Angle:	82	Confidence:	3
Pin, Pout:		Age:	oldish
Comments:			

Molehole #:	4		
Depth:	16	X:	78
D ¹ , D ² :	5, 4	Clarity:	3
Angle:	90	Confidence:	3
Pin, Pout:		Age:	oldish
Comments:			

Molehole #:	5		
Depth:	30	X:	98
D ¹ , D ² :	4, 4	Clarity:	2
Angle:	90	Confidence:	3
Pin, Pout:		Age:	oldish
Comments:			

Molehole #:	6		
Depth:	20	X:	23
D ¹ , D ² :	4, 4	Clarity:	3
Angle:	90	Confidence:	3
Pin, Pout:		Age:	recent
Comments:			

Date:	10/04/2014	Observers:	JW, GH, SS
Trench Name:	MM14	GPS Coordinates:	51 K 481291 7435271
Trench LENGTH:	130	Trench DEPTH:	79
Comments:			

MOLEHOLES

Molehole #:	1		
Depth:	27	X:	45
D¹, D²:	4, 6	Clarity:	2
Angle:	80	Confidence:	2
Pin, Pout:		Age:	old
Comments:			

Molehole #:	2		
Depth:	21	X:	54
D¹, D²:	4, 4	Clarity:	3
Angle:	90	Confidence:	3
Pin, Pout:		Age:	oldish
Comments:			

Molehole #:	3		
Depth:	31	X:	67
D¹, D²:	4.5, 6	Clarity:	3
Angle:	72	Confidence:	3
Pin, Pout:		Age:	oldish
Comments:			

Molehole #:	4		
Depth:	26	X:	104
D¹, D²:	4, 5	Clarity:	3
Angle:	38	Confidence:	3
Pin, Pout:		Age:	oldish
Comments:			

Molehole #:	5		
Depth:	8	X:	33
D¹, D²:	4, 4	Clarity:	3
Angle:	90	Confidence:	3
Pin, Pout:		Age:	oldish
Comments:			

Molehole #:	6		
Depth:	8	X:	37
D¹, D²:	4, 4	Clarity:	2
Angle:	90	Confidence:	3
Pin, Pout:		Age:	old
Comments:			

Date:	10/04/2014	Observers:	JW, GH, SS
Trench Name:	MM15	GPS Coordinates:	51 K 480885 7433521
Trench LENGTH:	126	Trench DEPTH:	80
Comments:			

MOLEHOLES

Molehole #:	1		
Depth:	46	X:	53
D¹, D²:	4, 5	Clarity:	1
Angle:	88	Confidence:	2
Pin, Pout:		Age:	old
Comments:			

Molehole #:	2		
Depth:	24	X:	90
D¹, D²:	4.5, 9	Clarity:	2
Angle:	75	Confidence:	3
Pin, Pout:		Age:	old
Comments:			

Date:	10/04/2014	Observers:	JW, GH, SS
Trench Name:	MM16	GPS Coordinates:	51 K 480778 7431990
Trench LENGTH:	120	Trench DEPTH:	76
Comments:			

MOLEHOLES

Molehole #:	1		
Depth:	47	X:	53
D¹, D²:	4, 5.5	Clarity:	3
Angle:	80	Confidence:	3
Pin, Pout:		Age:	oldish
Comments:			

Molehole #:	2		
Depth:	48	X:	69
D¹, D²:	4, 7.5	Clarity:	3
Angle:	80	Confidence:	3
Pin, Pout:		Age:	oldish
Comments:			

Date:	10/04/2014	Observers:	JW, GH, SS
Trench Name:	MM17	GPS Coordinates:	51 K 481055 7430696
Trench LENGTH:	1.2	Trench DEPTH:	82
Comments:			

MOLEHOLES

Molehole #:	1		
Depth:	30	X:	70
D ¹ , D ² :	4, 6	Clarity:	2
Angle:	90	Confidence:	3
Pin, Pout:		Age:	oldish
Comments:			

Molehole #:	2		
Depth:	33	X:	65
D ¹ , D ² :	4, 6	Clarity:	2
Angle:	90	Confidence:	3
Pin, Pout:		Age:	oldish
Comments:			

Molehole #:	3		
Depth:	31	X:	81
D ¹ , D ² :	3.5, 4.5	Clarity:	2
Angle:	90	Confidence:	3
Pin, Pout:		Age:	oldish
Comments:			

Molehole #:	4		
Depth:	21	X:	104
D ¹ , D ² :	3.5, 5	Clarity:	2
Angle:	60	Confidence:	3
Pin, Pout:		Age:	old
Comments:			

Molehole #:	5		
Depth:	57	X:	86
D ¹ , D ² :	3, 3	Clarity:	3
Angle:	90	Confidence:	3
Pin, Pout:		Age:	oldish
Comments:			

Molehole #:	6		
Depth:	30	X:	90
D ¹ , D ² :	3.5, 3.5	Clarity:	1
Angle:	90	Confidence:	2
Pin, Pout:		Age:	Very old
Comments:			

Molehole #:	7		
Depth:	25	X:	110
D ¹ , D ² :	4, 4	Clarity:	2
Angle:	90	Confidence:	2
Pin, Pout:		Age:	old
Comments:			

Date:	10/04/2014	Observers:	JW, GH, SS
Trench Name:	MM18	GPS Coordinates:	51 K 481154 7429815
Trench LENGTH:	110	Trench DEPTH:	86
Comments:			

MOLEHOLES

Molehole #:	1		
Depth:	40	X:	37
D¹, D²:	4, 7	Clarity:	2
Angle:	85	Confidence:	2
Pin, Pout:		Age:	old
Comments:			

Molehole #:	2		
Depth:	35	X:	82
D¹, D²:	4, 4	Clarity:	3
Angle:	90	Confidence:	3
Pin, Pout:		Age:	oldish
Comments:			

Date:	10/04/2014	Observers:	JW, GH, SS
Trench Name:	MM19	GPS Coordinates:	51 K 481140 7428017
Trench LENGTH:	117	Trench DEPTH:	90
Comments:			

MOLEHOLES

Molehole #:	1		
Depth:	36	X:	72
D ¹ , D ² :	3.5, 4	Clarity:	2
Angle:	90	Confidence:	3
Pin, Pout:		Age:	old
Comments:			

Molehole #:	2		
Depth:	22	X:	47
D ¹ , D ² :	4, 4	Clarity:	2
Angle:	90	Confidence:	3
Pin, Pout:		Age:	oldish
Comments:			

Molehole #:	3		
Depth:	34	X:	47
D ¹ , D ² :	4, 3.5	Clarity:	2
Angle:	90	Confidence:	3
Pin, Pout:		Age:	oldish
Comments:			

Molehole #:	4		
Depth:	4	X:	54
D ¹ , D ² :	4, 4	Clarity:	3
Angle:	90	Confidence:	3
Pin, Pout:		Age:	oldish
Comments:			

Molehole #:	5		
Depth:	33	X:	100
D ¹ , D ² :	6, 4.5	Clarity:	2
Angle:	90	Confidence:	2
Pin, Pout:		Age:	old
Comments:			

Date:	10/04/2014	Observers:	JW, GH, SS
Trench Name:	MM20	GPS Coordinates:	51 K 481155 7426876
Trench LENGTH:	117	Trench DEPTH:	80
Comments:			

MOLEHOLES

Molehole #:	1		
Depth:	5	X:	24
D ¹ , D ² :	4.5, 4.5	Clarity:	3
Angle:	90	Confidence:	3
Pin, Pout:		Age:	recent
Comments:			

Molehole #:	2		
Depth:	45	X:	89
D ¹ , D ² :	4, 4	Clarity:	3
Angle:	90	Confidence:	3
Pin, Pout:		Age:	oldish
Comments:			

Molehole #:	3		
Depth:	47	X:	100
D ¹ , D ² :	4, 5	Clarity:	2
Angle:	90	Confidence:	3
Pin, Pout:		Age:	old
Comments:			

Molehole #:	4		
Depth:	34	X:	62
D ¹ , D ² :	4, 4.5	Clarity:	2
Angle:	90	Confidence:	3
Pin, Pout:		Age:	old
Comments:			

Molehole #:	6		
Depth:	43	X:	68
D ¹ , D ² :	4, 4	Clarity:	2
Angle:	90	Confidence:	3
Pin, Pout:		Age:	old
Comments:			

APPENDIX B

Marsupial Mole Monitoring Record Data Table

Summary of main characteristics

D min

30	35	40	45	50	60
3	13	48	9	2	1
4%	17%	63%	12%	3%	1%

D max

30	35	40	45	50	55	60	70
3	8	30	9	9	1	6	4
4%	11%	39%	12%	12%	1%	8%	5%

Depth

0-10	11-20	21-30	31-40	41-50	51-60	60-71
9	10	23	15	14	4	1
12%	13%	30%	20%	18%	5%	1%

Age

Fresh	Recent	Oldish	Old	Very Old
2	3	40	30	1
3%	4%	53%	39%	1%

Marsupial Mole Monitoring Record Data Table

Site	Molehole Number	Depth (cm)	X (Distance from right edge - cm)	D min (cm)	D max (cm)	Clarity	Confidence	Angle	Age
MM1	1	20	30	4	4	3	3	90	oldish
MM1	2	43	44	3.5	3.5	2	3	90	old
MM1	3	48	47	3.5	3.5	2	3	90	old
MM2	1	32	6	4	4	3	3	90	oldish
MM2	2	8	69	4	4.5	3	3	90	fresh
MM2	3	43	60	4	4	3	3	90	oldish
MM2	4	34	90	3	3	2	3	90	oldish
MM2	5	53	97	4	4	2	3	90	old
MM3	1	8	78	4	7	3	3	10	recent
MM3	2	29	14	4	8	2	2	75	oldish
MM3	3	36	10	4	7	2	2	75	oldish
MM3	4	58	47	4	4	2	3	90	old
MM4	1	28	50	4	4	2	3	90	old
MM4	2	13	14	3.5	3.5	2	3	90	oldish
MM4	3	25	72	4	4	3	3	90	oldish
MM4	4	20	48	4	4	2	2	90	old
MM4	5	12	106	4	4	2	2	90	old
MM6	1	17	126	4	6	2	3	90	oldish
MM6	2	5	31	4	4	2	2	90	old
MM7	1	26	58	4.5	7	3	3	78	oldish
MM7	2	47	44	4	4	2	3	90	oldish
MM7	3	12	60	4	12	2	3	75	oldish
MM8	1	25	80	4.5	5	3	3	90	fresh
MM8	2	62	38	4.5	4.5	2	3	90	oldish
MM8	3	14	119	3.5	4	2	2	90	oldish
MM8	4	7	32	3.5	4.5	2	3	90	oldish
MM9	1	40	22	3.5	3.5	2	3	90	oldish
MM9	2	10	31	3.5	3.5	3	3	90	oldish
MM9	3	16	23	4	4	2	3	90	oldish
MM10	1	26	57	3.5	5	2	3	64	oldish
MM10	2	30	34	4	5	2	2	55	old
MM10	3	27	106	4	15.5	3	3	75	oldish
MM10	4	35	112	3.5	3.5	2	3	90	old
MM11	1	47	33	3	3	2	2	90	old
MM11	2	53	115	4.5	5	2	3	90	old
MM11	3	23	115	4.5	6	2	3	90	old
MM12	1	26	66	4	4	2	2	90	old
MM12	2	24	47	4	4	2	2	90	old
MM12	3	48	51	4.5	4.5	2	2	90	old
MM12	4	50	15	4	4.5	2	3	90	old
MM12	5	50	25	4	5	2	3	90	old
MM13	1	22	32	4	4	3	3	90	oldish
MM13	2	34	40	4	4	3	3	90	oldish
MM13	3	21	70	5	8	2	3	82	oldish
MM13	4	16	78	5	4	3	3	90	oldish
MM13	5	30	98	4	4	2	3	90	oldish
MM13	6	20	23	4	4	3	3	90	recent
MM14	1	27	45	4	6	2	2	80	old
MM14	2	21	54	4	4	3	3	90	oldish

Site	Molehole Number	Depth (cm)	X (Distance from right edge - cm)	D min (cm)	D max (cm)	Clarity	Confidence	Angle	Age
MM14	3	31	67	4.5	6	3	3	72	oldish
MM14	4	26	104	4	5	3	3	38	oldish
MM14	5	8	33	4	4	3	3	90	oldish
MM14	6	8	37	4	4	2	3	90	old
MM15	1	46	53	4	5	1	2	88	old
MM15	2	24	90	4.5	9	2	3	75	old
MM16	1	47	53	4	5.5	3	3	80	oldish
MM16	2	48	69	4	7.5	3	3	80	oldish
MM17	1	30	70	4	6	2	3	90	oldish
MM17	2	33	65	4	6	2	3	90	oldish
MM17	3	31	81	3.5	4.5	2	3	90	oldish
MM17	4	21	104	3.5	5	2	3	60	old
MM17	5	57	86	3	3	3	3	90	oldish
MM17	6	30	90	3.5	3.5	1	2	90	very old
MM17	7	25	110	4	4	2	2	90	old
MM18	1	40	37	4	7	2	2	85	old
MM18	2	35	82	4	4	3	3	90	oldish
MM19	1	36	72	3.5	4	2	3	90	old
MM19	2	22	47	4	4	2	3	90	oldish
MM19	3	34	47	4	3.5	2	3	90	oldish
MM19	4	4	54	4	4	3	3	90	oldish
MM19	5	33	100	6	4.5	2	2	90	old
MM20	1	5	24	4.5	4.5	3	3	90	recent
MM21	2	45	89	4	4	3	3	90	oldish
MM22	3	47	100	4	5	2	3	90	old
MM23	4	34	62	4	4.5	2	3	90	old
MM24	5	43	68	4	4	2	3	90	old

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